RE-INVENTING RADIO

ASPECTS OF RADIO AS ART

Heidi Grundmann
Elisabeth Zimmermann
Reinhard Braun
Dieter Daniels
Andreas Hirsch
Anne Thurmann-Jajes

Inventing and Re-Inventing Radio

Dieter Daniels

The advent of technical media can never be pinpointed to a specific date or a single individual. Photography, film, and television illustrate this by example, as does radio. The initial conceptualization of these media often astoundingly emerges in parallel, in several different places at the same time, with several stages of development usually necessary before a functioning medium can be established. For this reason, the concept of an «invention» must be supplemented with the aspects of its «relatedness» and «utilization.» «Relatedness» stands here for various genealogical branches as well as for the possible connections between completely separate origins by means of «marriage,» out of which emerge new branches of «relatedness.» «Utilization» in turn denotes the usage to which a medium is subjected by its users, a circumstance that cannot be controlled by the inventor or the producer and is, at times, diametrically opposed to its original intention.

The year 2006 presented several good reasons to celebrate a century of radio. For instance, on Christmas Eve 1906, Reginald Fessenden made the first public broadcast of speech and music. Coincidentally, further technical foundations for radio were laid the very same year, including the invention of the electron tube and the detector. Although it would take another fifteen years for radio to achieve

its breakthrough as mass medium, 1906 nevertheless represents a crucial formative moment for radio. The fact that this 2006 anniversary was marked by only marginal public acknowledgement signifies how little historical awareness exists—in comparison, for example, to the worldwide celebrations of 100 years of film in 1995—and how weak the theoretical underpinnings of radio still are.[1]

A second reason for now devoting more attention to the dawn of radio history is the current synthesis of Internet audio streaming, W-LAN, podcast, and mobile telephony to create a common hybrid medium with broadcast radio. This trend heralds a dissolution and diversification of the classic mainstream medium of broadcast radio. The transition from wireless telegraphy to broadcast radio, having begun in 1906, is now undergoing a revision one hundred years later, with the original potential of networked communication for integrating users returning to everyday life. Radio art has anticipated this trend in many ways during the past thirty years, developing exemplary scenarios for a non-hierarchical, decentralized, and participative form of radio. Radio art can thus be regarded as the springboard for a re-invention of radio, having recalled to consciousness the aspects of media «relatedness» and their alternative «utilization,» which had been marginalized by radio as mainstream medium.

The Fourfold Invention of Radio

Four stages can be discerned in the «invention» of radio, spanning over a period of four decades:

circa 1880: utopia and practice of telephone distribution
1895: wireless technology
1906: broadcast of voice and music
1920: amateur radio boom in the U.S.

1 The disregard for this date was one theme of the symposium The Return of Wireless Imagination – 100 Years of Radio, January 17 to 19, 2007, RadioKulturhaus Wien, hosted by *Kunstradio* and the Ludwig Boltzmann Institute Media.Art.Research. This event likewise occasioned the compilation of the essays by Wolfgang Hagen, Wolfgang Ernst, Daniel Gethmann, and Inke Arns for this volume.

2 Norbert Wiener, *Invention: The Care and Feeding of Ideas* (Cambridge, MA and London, 1993), pp. 7–9.

3 In this respect, see the essays by Wolfgang Ernst and by Wolfgang Hagen in this volume, which examine the technical history of radio from an epistemological and media-archaeological viewpoint, as well as the essay by Daniel Gethmann, which explores the political, economic, and social development of radio.

Only after this long course of development does one-to-many broadcasting become the «killer application» of wireless, which has ever since dominated the wave spectrum and further technological progress. The complexity and colorful history of such «inventions» is retraced by Norbert Wiener in his book *Invention: The Care and Feeding of Ideas*. Wiener's four stages of invention do not completely coincide with the stages of radio development proposed here, but there are certain analogies:[2]

- Change in the intellectual climate (effectiveness of the individual is enormous)
- Existence of proper materials or techniques (not a part of the original idea but necessary for its execution)
- Social climate and particular date (often same invention made independently in many places)
- Economic climate (depending on individual and class as entrepreneurs)

A significant breadth of time and space may lie between these stages, as demonstrated by the centuries-long process of «technology transfer» from China to Europe, in which paper and gunpowder later proved fundamental to the development of printing and firearms.

Consequently, caution is called for when pinpointing the birth dates of media! By means of the right facts, an inverted order could easily be constructed: in 1883, Paul Nipkow «invented» an «electric telescope»—but only on paper, for he received a patent but lacked the means for constructing his design. This, however, did not prevent German television stations from celebrating 100 years of television in 1983. The year 1895 is recognized as the year film was born. Applying the assumption that the development of radio began in 1906, the following odd sequence of media would ensue: in 1883 television, then in 1895 film, and finally in 1906 radio. In actuality, television as mass medium only became conceivable through the synthesis of film and radio, and its institutional and technical history as wireless image broadcasting began in the late nineteen-twenties.

Hence, instead of a techno-historical representation, the proposed approach here can be more aptly characterized as «media anthropology.»[3] It is only from this perspective that those social, cultural, and economic factors—decisive for the above-named «relatedness» and «utilization,» rather than «invention,» as-

pects of media—become manifest. To provide an example: in 1876 and 1887 respectively, two completely independent discoveries or inventions were made, which ended up converging in today's employment of radio as mass medium. In 1876, the electric telephone was invented by Bell and the mechanical phonograph by Edison and, in 1887, the experimental measurement and transmission of electromagnetic impulses by Hertz and the gramophone record by Berliner. Radio's commercial success as mass medium of the hit parade can only be understood through the convergence of these four factors, which led to the «marriage» of Hertz's laboratory experiments with the mass production of records as sound carriers, thus having given rise, starting in the nineteen-twenties, to a new chain of «relatedness.» As early as the eighteen-seventies, utopias likewise emerged—parallel to the technical foundations—for radio and television as future mass media. These planted the seeds in public consciousness, creating what Wiener refers to as the first stage necessary for an invention: the right «intellectual climate.» Accordingly, the four stages in the development of radio and their interconnections will be examined in the following.

1880s

The Utopia and the Practice of Telephone Distribution

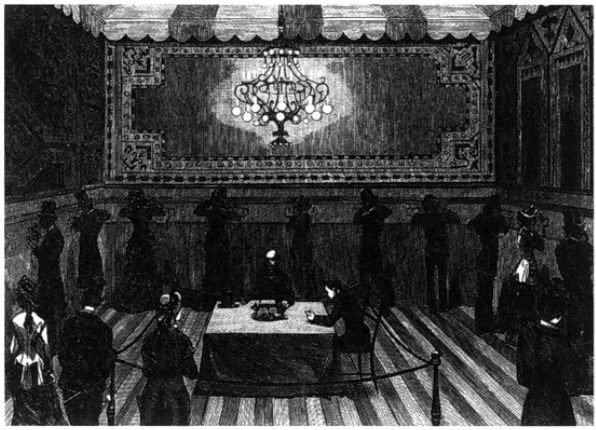
A tele-distribution anticipating the one-to-many principle of broadcasting would already have been possible in principle with the telephone. As a matter of fact, when Graham Bell introduced his telephone, the American press feared that news distributed via the faster medium could pose some serious competition. Soon thereafter, practical attempts were made at using the new medium for entertainment. At the Exposition International d'Électricité (World Exhibition of Electricity) in 1881, for example, people stood in line to hear music from the Paris Opéra transmitted for the first time in stereo. Even before the invention of the telephone, a caricature in *Punch* in 1849 foresaw the possible consequences of music transmission via telegraph line, of which there were rumors coming from America: «The grand point of the invention seems to be, that, if songs can be car-

4 *Punch* 17, no. 440 (1849), p. 225.

5 Albert Robida, *Le XXème siècle* (Paris, 1883).

ried along the lines, our popular vocalists may treble or quintuple their present salaries, by singing in four or five places at once.»[4] What Wiener posits as the last stage of invention, the right «economic climate,» was thus already imaginable over 150 years ago.

Caricaturist Albert Robida sketched in 1883 in *Le XXème siècle* a vision of electrical sound and image transmission via *téléphonoscope* as part of a complete media system. This had far-reaching social, cultural, and economic implications, just as this vision would become a reality in the face of radio and television in the twentieth century.[5] Robida's most significant thesis lay in the predicted synthesis of telephone, phonograph, and *téléphonoscope*, forming the foundation for a new industry using the distribution capacity of these media to propagate a whole range of new multimedia offers. The tele-theater company he imagined as being founded in 1945 has 600,000 subscribers worldwide, whose subscription fees pay the respective theater, which can then reach an audience of up to 50,000 for each performance. A big music factory in downtown Paris electrically supplies all subscribers with the performances they have booked. The occupation of musician, limited to a few factory employees, is therefore virtually disappearing, as is likewise the piano from the home.



Live stereo transmission from the Paris Opera to the World Exhibition of Electricity, Paris, France, 1881.

Comparable technical utopias can be found in another futuristic novel on the twentieth century, Edward Bellamy's *Looking Backward 2000–1887*, where they are, however, tied to socio-utopian ideas.[6] Here, technical progress and human insight into the evils of capitalism have given rise to a new form of society based wholly on the principles of cooperation and equality. Cash has been replaced by credit cards with equal rationing thereof. The production of goods is centralized; people order items based on samples, and merchandise is delivered via a pneumatic tube system directly to the customer's home. Making music in the home has also become superfluous since four programs are available around the clock, transmitted live from concert halls via telephone to every home, with perfect acoustics. Interestingly, Robida's humoristic-capitalist and Bellamy's moralistic-socialist visions of the future both draw on the same imagined media distribution technique.

Returning now from the realm of science fiction back to reality: starting in 1893 until the Second World War, Budapest boasted a program for news and music called «Telefon Hírmondó.» This operation set a new record as regards the media-technical acceleration of information distribution, offering brief and precise news updates twenty-eight times a day.[7] The most ambitious and disastrous attempt to use the telephone network for the distribution of electrically generated music was the Telharmonium, invented and built by Thadeus Cahill in 1900. It inspired Ferruccio Busoni's radical musical theory and anticipated the synthesizer by decades, but it never managed to supply the necessary number of lines with simultaneous audio signals, despite it having been redesigned in 1906 and 1911, causing the loss of significant amounts of venture capital.[8]

Despite all of these utopias, caricatures, and practical attempts, the expansion of industrial production and distribution methods—aimed at encompassing a nonmaterial commodity like the electrical delivery of culture and information—nevertheless did not make substantial inroads during the nineteenth century. The resulting question of «why» is one of the unsolved riddles of media history.

6 Edward Bellamy, *Looking Backward 2000–1887* (Boston, 1888).

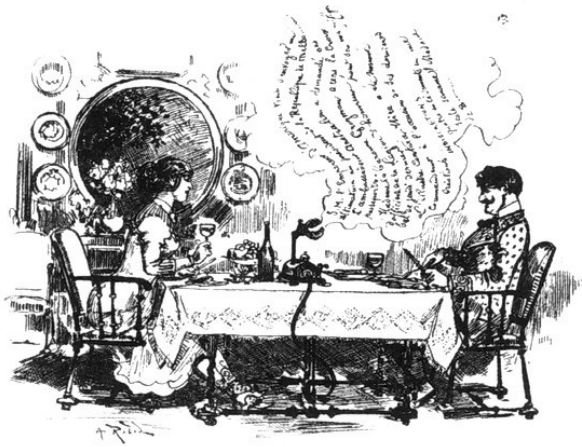
7 See Miklós Peternák, «Der Beginn der zentralen Programmsendung – Budapest 1893,» *Lab* (Kunsthochschule für Medien Köln) (1997), pp. 373ff.

8 See Wolfgang Hagen on the Telharmonium in Dieter Daniels and Barbara Schmidt, eds., *Artists as Inventors – Inventors as Artists* (Ostfildern, 2008).

1895
Wireless Technology

Wireless technology was not initially recognized as a completely new medium, but as a further development of cable telegraphy for areas that are hard to reach by cable. In 1895 and 1896, wireless telegraphy, like all important media previously, was being developed by many inventors simultaneously, of whom we can only name a few here: Guglielmo Marconi, who received the Nobel Prize for this innovation; Alexander Popov, honored annually in Russia with Radio Day on May 7; Oliver Lodge, who is cited in the Encyclopaedia Britannica; Nathan B. Stubblefield, who despite initial success as an inventor would end up starving to death, identified on his gravestone in Kentucky as the «Father of Radio»; Professor Adolf Slaby, who personally apprised Kaiser Wilhelm and his wife of the latest developments at Hubertusstock Palace near Potsdam; and finally, Nikola Tesla, who today enjoys great popularity in media art as well as amongst devotees of esotericism.

Apart from a simultaneity of ideas that never ceases to amaze, the unpredictable «marriage» of media can once again be demonstrated here: likewise in 1895, that banner year for radio, the Lumière brothers in Lyon as well as the



News transmission at the dining table per *téléphonoscope* from Albert Robida, *Le XXème siècle*, Paris, France, 1883.

Skladanowsky brothers in Berlin, along with additional inventors in Washington, New York, and London, all projected films before the public for the first time. From a present-day perspective, the convergence of the two media radio and film led to television. But at the time of its emergence, radio initially remained strictly bound to the paradigm of cable telegraphy and had no connection whatsoever with the simultaneous practice and utopia of tele-distribution.

On the contrary: for Marconi and all the other inventors, the radial broadcast capacity of wireless posed a problem, with interferences from numerous stations not only disrupting military use and jeopardizing the secrecy of classified communications but also making civilian use difficult. Marconi reports: «This defect preoccupied me to such an extent that my main research efforts were directed for many years at eliminating it.»[9] The idea of broadcasting to random recipients was not even mentioned as a possibility at the international conferences on wireless telegraphy in 1903 and 1906.

Of all the wireless inventors in the years surrounding 1895, only Nikola Tesla recognized the potential for radial and global broadcasting. He justified the construction of his Wardenclyffe Tower for international broadcasting (which was never completed and presumably would never have functioned) by citing the «moral effect» to be expected from a global communication envisaged to change the course of history. This socio-utopian dimension links him to Bellamy's belief in a happy future through technology. In 1904, Tesla noted:

> World Telegraphy ... will prove very efficient in enlightening the masses, particularly in still uncivilized countries and less accessible regions, and ... it will add materially to general safety, comfort, and convenience, and maintenance of peaceful relations. It involves a number of plants, all of which are capable of transmitting individualized signals to the uttermost confines of the earth. Each of them will be preferably located near some important center of

9 Marconi 1937, quoted in Friedrich Kittler, *Grammophon, Film, Typewriter* (Berlin, 1986), p. 363. The fact that a conference celebrating 100 years of radio already took place in 1995, based on Marconi's invention of wireless telegraphy in 1895, can be primarily attributed to the fact that the English word «radio» fails to differentiate between point-to-point and one-to-many communication. See the International Conference on 100 Years of Radio, IEE CP 411, ISBN 0 85296 649 0 (1995).

10 Tesla in an article in *Electrical World Engineer*, March 5, 1904, quoted in Margaret Cheney, *Tesla: Man out of Time* (Englewood Cliffs, NJ, 1981), p. 178.

11 Lee de Forest, *Father of Radio: The Autobiography of Lee de Forest* (Chicago, 1950), pp. 86 and 449.

civilization, and the news it receives through any channel will be flashed to all points of the globe. A cheap and simple device, which might be carried in one's pocket, may be set up anywhere on sea or land, and it will record the world's news or such special messages as may be intended for it. Thus the entire earth will be converted into a huge brain, capable of response in every one of its traits.[10]

1906
Broadcast of Voice and Music
Reginald Fessenden and Lee de Forest

Tesla served as the great paragon for Reginald Fessenden and Lee de Forest, the pioneers of broadcasting. Like Tesla, both were minister's sons who from the onset approached their radio activities with a parareligious touch—the reason Fessenden decided to hold his first test broadcast on Christmas Eve in 1906. In the case of Lee de Forest, reading Nikola Tesla's texts on high-voltage electrotechnology aroused the desire «to myself enter into that tenuous realm that is the connecting link between God and mind and lower matter.» He later reflected on his contribution to radio, stating that he was «proud to have had a prominent part in this new evangel.»[11]

Let us try to imagine the fascination «wireless» must have held for people one hundred years ago. The discovery of wireless telegraphy in 1895 opened up what is termed the «ether,» an as yet unknown and still mysterious sphere, charged with just as many hopes and enigmas as cyberspace would be at the end of the following century. Human and technical communication signals mixed in with the hissing and crackling of cosmic radiation—the code of the Morse Alphabet freed itself from the wire and swung its way onto the yet poorly understood waves of the electromagnetic spectrum. At first, it was considered improbable that modulated tones, meaning human voices or music, could be transmitted by such waves.

This assumption only changed on that momentous Christmas Eve in 1906, which Reginald Aubrey Fessenden spent not at home but rather, with his family, in front of the microphone at his sparely furnished wireless laboratory in Brant Rock, Massachusetts. He played the song «O Holy Night» by Gounod on his violin, sang a few stanzas, and read aloud some verses from the Gospel according to Luke. Listening in were professional radio operators on ships at sea as well as

amateurs who found wireless telegraphy a fascinating hobby. For many of them, it must have been surprising to suddenly have heard, instead of the monotonous peeping of Morse Code, musical harmonies and human voices emanating from their headphones. Some marine radio operators couldn't believe their ears and «called in their officers to listen alongside them; soon the radio cabins were full of people.»[12] Fessenden had alerted listeners to the date and frequency for his experiment per advance telegraph in order to ensure that an audience would witness the success of his test.[13] After all, the experiment was also designed to act as an advertisement for his development of the «wireless telephone,» without him even having yet contemplated a mass medium.

The first inventor to have used the term «broadcasting» for a transmission of music and speech to all those with a receiving device was Lee de Forest.[14] He made a further important discovery applicable to radio in 1906: the first electronic amplifier tube, or triode. He dubbed it «Audion,» alluding to the new acoustic world of sound that it could facilitate through transmission. Replacing the extremely expensive, large, turbine-like high-frequency transmitter used by Fessenden—which generated alternating current frequencies through a high number of revolutions—a small vacuum tube entered the picture, affordable even for amateurs producing an audio signal strong enough for broadcasting.[15] This invention ushered in the transition from electromechanical to electronic broadcasting and receiving, making radio's route to mass medium possible in the first place. The types of inventor embodied by Fessenden and de Forest are just as distinct as their technologies: Fessenden and his team worked with scientific ad-

12 Erik Barnouw, *A Tower in Babel*, vol. 1, *A History of Broadcasting in the United States* (New York, 1966), p. 20. See also Daniel Gethmann's essay in this volume.

13 Christopher H. Sterling and John M. Kittross, *Stay Tuned: A Concise History of American Broadcasting* (Belmont, CA, 1978), pp. 28–29 and 40. Fessenden maintained that he had already made a test broadcast on December 11, 1906 for invited specialists and the press; see Reginald Aubrey Fessenden, *The Deluged Civilization of the Caucasus Isthmus* (Boston, 1923), p. 117. He broadcast again on New Year's Eve, comparable to his Christmas broadcast; Barnouw 1966 (see note 12), p. 20.

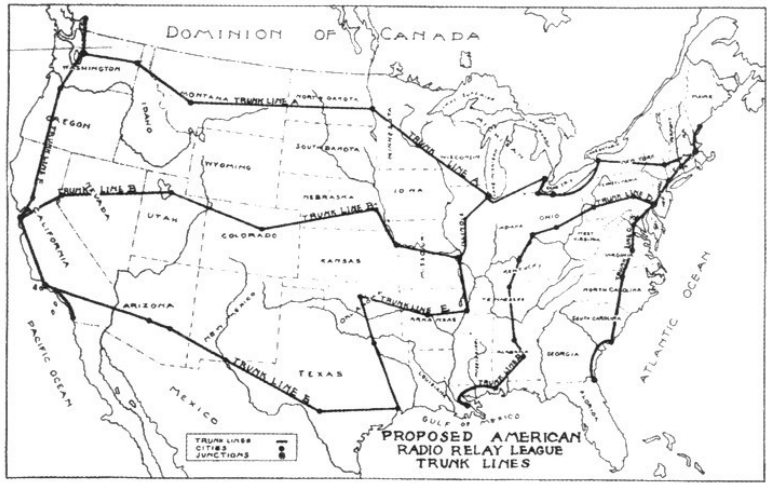
14 Significantly, this first use of the term takes place in 1907 in a love letter from the aspiring poetry writer de Forest. The term originally stems from agriculture, indicating the scattering of seeds by hand. See Dieter Daniels, *Kunst als Sendung: Von der Telegrafie zum Internet* (Munich, 2002), p. 97.

15 The radio tube is another parallel invention, developed simultaneously by Lee de Forest and Robert von Lieben in 1906 (see the essay by Wolfgang Ernst in this volume). The Audion tube was, starting in 1907, initially used for amplification only on the receiving side; only later did de Forest discover that it can also amplify the broadcasting signal. Likewise in 1906, the simplest and least expensive form of receiver was discovered, the crystal detector that would find widespread use well into the nineteen-twenties.

vising and industrial capital, whereas de Forest began as an amateur and, despite his intermittent successes, remained a solitary figure. Lee de Forest is the last hero in a long line of inventors-as-tinkerers, who, like Edison and Marconi, produced results through mere trial and error, without a scientific background and above all without mathematically calculating the physical processes involved.

1920–22
From Radio Amateur to Radio Boom

Even after the experiments conducted by Fessenden and de Forest, the transmission of sound remained the exception, while Morse Code continued to prevail as the lingua franca of the frequencies. This also applied to the networked community of amateur radio enthusiasts spread out across the entire North American continent, as described by Francis A. Collins in his book for young readers, *Wireless Man*, of 1912: «An audience of a hundred thousand boys all over the United States may be addressed almost every evening by wireless telegraph. Beyond doubt this is the largest audience in the world. No football or baseball crowd, no convention or conference, compares with it in size ... The skylines of every city



Proposal for the network of the amateur association American Radio Relay League (ARRL) by Hiriam Percy Maxim from *QST*, February 1916.

in the country are festooned with the delicate antennae of the wireless operators. They will be found skillfully adjusted to thousands of barns or haystacks in the most remote parts of the country.»[16] Until the Radio Act passed in 1912, no rules or regulations restricted amateur use of the ether. In North America of that era, the frequencies of the electromagnetic spectrum might even be called a natural resource. Many amateurs were only acquainted over the air, making for a true grassroots community beyond industrial or state control. Just before World War I, the amateur association American Radio Relay League—anticipating that telephone and telegraph lines might be damaged by hostilities—proposed a nationwide amateur network, which in some aspects prefigured the distributed relay network of the Internet. But instead, all amateur wireless stations were ordered to close down for security reasons and did not go back on-air until 1919.

Wireless telegraphy has opened up a new communications space that is in principle accessible to everyone. The «tech talk» of the amateurs often makes the social and aesthetic dimensions of the medium appear less significant.[17] The medium itself is their primary theme: just as the e-mails exchanged by hackers usually center around computers, radio amateurs generally communicate over the airwaves about radio technology. McLuhan's dictum «the medium is the message» can be taken quite literally here.[18] But the point is in fact less the actual

16 Francis A. Collins, *The Wireless Man, His Work and Adventures on Land and Sea* (New York, 1912), p. 26. According to estimates made by the *New York Times*, several hundred thousand amateurs were already active by 1912. See Susan J. Douglas, *Inventing American Broadcasting 1899–1922* (Baltimore and London, 1987), pp. 199–200.

17 See *QST*, the magazine for amateur radio enthusiasts that has been published regularly from 1915 to the present.

18 Later on, this even becomes part of the state regulations imposed on amateur wireless to prevent them from interfering with broadcast radio. This had lead to frustration on the part of artists trying to collaborate with radio amateurs for the project *Kunstfunk* in Vienna in 1984: «In a sense, Kunst-Funk was a sentimental attempt to experience what radio might have been like if it had not become a centralised mass medium. But the strict licensing regulations and restrictions on content (e.g., no meaningful information aside from name, address, call-letters, and discussion of equipment—and radio amateurs are regularly monitored, and prosecutions for infringements can result in confiscation of equipment or worse) have resulted in a ghetto mentality by radio amateurs, which makes them extremely suspicious of outsiders and frightened of coming into conflict with the authorities by trying anything new—such as working with artists.» See http://alien.mur.at/rax/KUNSTFUNK/index.html (accessed October 22, 2007).

19 See Dieter Daniels, «The Miracle of Simultaneity: Anticipations of Globalisation at the Beginning of the 20th Century,» in *Ohne Schnur: Art and Wireless Communication*, ed. Katja Kwastek, exh. cat. Kunstverein Cuxhaven (Frankfurt am Main, 2004), pp. 36–61.

20 In Europe, starting in 1919 several broadcasting pioneers likewise begin making regular music broadcasts, however these did not culminate in as widespread of a movement as in the U.S. due to the fact that in Europe the state maintains control over all broadcasting and reception activities.

content of the communication than the way the communication process itself is used and structured—a process whose networked, international, and simultaneous presence implies eminently aesthetic experiences. While American amateur radio fans were perfecting their technique, simultaneity was being propagated in the poetry and paintings of the European avant-garde. Guillaume Apollinaire, Robert Delaunay, and F. T. Marinetti, in particular, related the idea of simultaneity directly to wireless technology, without however putting this idea into media practice.[19] Not until the radio art of the last thirty years, for example the projects *Chipradio* (1992) and *Realtime* (1993), has a comparably explicit aesthetic self-reflection of the changing medium occurred within the medium itself. In the heroic age of media and modernism, this connection between American amateur practice and European aesthetic reflection has failed to materialize.

The American radio amateurs would end up playing the decisive role in the breakthrough of broadcasting as a mass medium. Following the caesura of World War I, during which all private radio was prohibited for reasons of national security, the so-called «radio boom» emerged in 1920 in the U.S. and Canada, as pioneers began to step up broadcasting of music and speech.[20] In addition to the networked community of amateurs sending and receiving Morse Code, a «normal

"Wait until the dumb-bells get poisoned with these litle dit-dit's"

Cartoon from the magazine for radio amateurs *QST*, May 1922.

audience» also began to take an interest in sound broadcasting. A then-contemporary cartoon illustrates how the amateur apparatus operated by a male radio fanatic was all at once transformed to a new center of attraction for the entire family, all wanting to listen to the music emanating from the device. The amateur movement thus gave birth to the first radio listeners in a genuine sense. This transition from medium of communication amongst initiates to medium of reception for anyone forms the true moment comprising the «invention» of radio as mass medium.

Only after some delay did the industry also recognize this chance to revive demand for radio technology, which had been flagging since the end of the war. This is the reason for the second date that is often cited as the first radio broadcast: a live report of the counting of votes in the American presidential election of November 2, 1920, broadcasted by the station KDKA, operated by the Westinghouse Electric Company engineer Frank Conrad, who had spun his hobby as a radio amateur into his profession. But neither does this famous political live broadcast, heard by several thousand listeners in 1920, mark a concrete beginning of the mass medium of radio—because where did these listeners actually come from? The history of the broadcasters therefore does not answer the question of the actual driving force behind the radio boom. There is no «first radio broadcaster,» and radio does not have an «inventor.» The idea behind it was not born of a single mind, nor of several minds in parallel, as with so many other media inventions; instead, it has grown as a phenomenon out of a social process that is based in heart not on a new technology but rather on a new utilization. The audience was already there before broadcasters even got started. Or, to put it more dramatically: *radio was invented by the listeners*.[21]

For the first time in media history, the users were the force dictating the launch of a mass medium. The do-it-yourself community of wireless amateurs created the basis for the «early adopters» among radio hobbyists, who, however, were no longer interested in Morse communication but rather only in receiving sound broadcasts. In this way, the avant-garde, so proud of its autonomy, ulti-

21 For a more detailed description, see Daniels 2002 (see note 14), pp. 131ff.

22 On the commercialization of radio, see Dieter Daniels, «A Hundred Years of Radio's Potential,» in *Relating Radio. Communities. Aesthetics. Access, Beiträge zur Zukunft des Radios*, ed. Golo Foellmer and Sven Thiermann (Leipzig, 2006), pp. 34–49.

23 See Patrice Flichy, *The Internet Imaginaire* (Cambridge, MA and London, 2007).

mately paved the way for its own marginalization. Starting in 1922, the electronics industry began to manufacture ready-to-use radio receivers for the consumer and was soon unable to meet rapidly escalating demand. Six hundred new stations went on the air that year, and the radio boom grew into a mass movement, from which there was no turning back. The sound of the new medium gave the «Roaring Twenties» its name. This spelled the end of the once open, communicative, and networked structure of the medium, with the new «killer application» of broadcast radio forming a centralized transmission medium, whose further «formatting» would soon be geared toward commercial criteria.[22]

Broadcasting would go on to become the most powerful instrument for mass distribution in the history of mankind, yet this did not come about based on an industrial or state mandate but rather through its own bottom-up momentum stemming from the amateur movement. This is a process that could only have taken place in the U.S., where a large quantum of legal freedom provides the requisite leeway, while in European countries, radio was not to prevail until two or three years later, introduced top-down as a state-controlled instrument. This difference between the U.S. and Europe was repeated in the nineteen-nineties with the breakthrough of the Internet as a mass medium, likewise emerging from a grassroots community.[23] In both cases, the varying legal regulations are merely an expression of the fundamentally different role media technology plays for society: in the U.S., the terrain of the ether and also of cyberspace have been conquered and marketed based on individual initiative, in keeping with the tradition of the «go west» mentality, while in Europe the state has always taken it upon itself to intervene as a regulating and cultivating force.

Re-Inventing Radio

The birth of radio was based on a new way of implementing existing technologies, shaped decisively by the users and not by industry or individual inventors. This is what makes media archeology and radio theory so pertinent and necessary for the present return of the wireless and the new role of the user in the Internet. The current signs of dissolution of the centralized mass media radio and television make the initial ideas hatched one hundred years ago, at the beginning of the era of broadcasting, seem quite up-to-the-minute again: «Broadcast Yourself» is the motto chosen by youtube.com, words that could also have formed the central

message of radio pioneers like Fessenden, de Forest, and the radio amateurs. Today, this promise made by YouTube pulls millions of short videos onto the most successful video distribution platform on the Internet, worth the immense sum of 1.65 billion dollars to the operators of Google. Many of these videos were shot with mobile phones, and they can be called up and viewed wirelessly as well. This convergence of the media television, radio, Internet, and mobile telephony is no longer a coincidence of technological history but alternately a hotly contested development goal in the industry, with the ultimate aim of fusing marketing strategies for the requisite technologies and products. But even for this new developmental push, the impetus came not from the industry but from the users. Podcasting, the precursor to platforms like YouTube, experienced a boom in 2004 comparable to that of radio in the nineteen-twenties, arising primarily from linking blogs with other forums for user-generated content.[24] Along with Tom Sherman, Andrew Garton, and Matt Smith, in this volume artists from different generations comment on this situation of yet another «paradigm shift.»

With the breakneck speed of digital media developments, it's easy to forget that many of the concepts that are today changing and reformatting the principle of broadcasting under the catchword Web 2.0 have already been around for decades, in a similar form, in the realm of media art. This includes early pre-Internet telecommunications art (see, for example, Daniel Gilfillan on Robert Adrian or Candice Hopkins on Hank Bull in this volume) and, since the mid-nineties, models for the connection of radio, Internet, telephone, and ISDN lines, such as *State of Transition* (1994), *Horizontal Radio* (1995), and *Other Voices* (1999). In these projects, Daniel Gilfillan discovers not only a serious consideration of migration issues but also strategies of «subverting broadcasting practices of standardized content and transmission procedures» and a demonstration «that alternatives to a globalized telecommunications structure and homogenous cultural

24 On the emergence of podcasting, the daily newspaper *USA TODAY* writes: «Big tech and media companies could not have foreseen this potentially disruptive hitch to their grand strategies... Like the blogging phenomenon, podcasts have come out of nowhere to attract an enthusiastic grassroots following.» Byron Acohido, «Radio to the MP3 Degree: Podcasting,» *USA TODAY*, Feb. 9, 2005, http://www.usatoday.com/tech/news/2005-02-09-podcasting-usat-money-cover_x.htm.

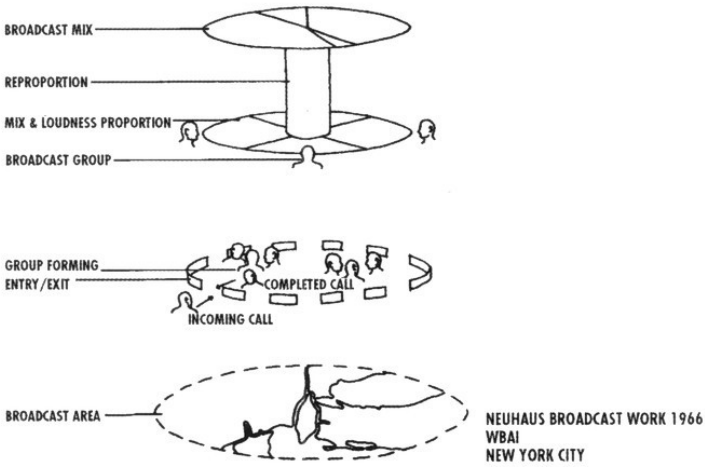
25 See Daniel Gilfillan, «Broadcast Space as Artistic Space,» in this volume.

26 See August Black, «An Anatomy of Radio,» in this volume.

27 Bertolt Brecht, *Werke XXI, Schriften 1* (Frankfurt am Main, 1992), pp. 217 and 553. The speech «Der Rundfunk als Kommunikationsapparat» («Radio as Communication Apparatus») was held in 1930, not in 1932, and has only been accessible again since 1966. See Klaus-Dieter Krabiel, *Brechts Lehrstücke* (Stuttgart, 1993), p. 108.

content are possible.»[25] Even more radically, the concept of centralized broadcasting is put into question by examples of artist-developed and artist-run open platforms for user content like ORANG–Open Radio Network Group, until 2002, or the Cultural Broadcasting Archive of the Federation of Austrian Free Radios and r a d i o q u a l i a ' s *Frequency Clock*, as discussed by August Black.[26] Looking back, we can today regard these media art practices as an anticipation of the current sea change in the media hierarchy of broadcasting.

From this present-day perspective—against the backdrop of the developmental history of radio as sketched above—the development of radio art can be considered on the whole an ongoing re-invention of the medium and of its lost aesthetic and communicative potential. This history of re-invention was already initiated in 1927 with Bertolt Brecht's criticism of radio as an «antediluvian invention.» The demand he voiced in 1930 that «radio must be transformed from a distribution apparatus into a communication apparatus» has, since its reiteration by Hans Magnus Enzensberger in the nineteen-seventies, become a standard postulate in all left-wing media criticism.[27] Ten years after the American radio boom, Brecht actually should have been calling for a return of radio to its communicatively networked origins—but he fails to make this connection. Brecht's



Max Neuhaus, *Public Supply I*, network diagram, 1966.

settling of accounts with radio rests upon his experience with «Lindberg's flight,» a failed attempt at a participatory radio play just one year before. Brecht thus also stands for the conflict between institutionalized broadcasters and artistic interventions running through the entire continued history of radio art.

That radio art, just like other forms of art, transpires in the mind of the beholder—and not in the hopeless attempt to change the broadcast institutions—can be concluded from John Cage's approach. After having created a few radio pieces under contract, Cage subjected the medium to a radical re-invention in 1952, at the high point of the Top 40 format, using it no longer as programming source but rather as randomly generated raw material. In *Imaginary Landscape No. 4*, for twelve radios and twenty-four performers, he turns reception into composition by means of a live remix of stations. «It is thus possible to make a musical composition the continuity of which is free of individual taste and memory (psychology) and also of the literature and ‹traditions› of the art. The sounds enter the time-space centered within themselves ...» is how Cage describes his goals.[28] Questions of authorship and public, as they come to fore in the networked radio art of the nineties, are already in evidence here. At the same time, this re-empowerment of the listener/receiver is a reaction against the slackening of format radio into mere background noise: «You can leave the room, and when you come back, you've missed nothing,» writes *Time* magazine in 1958, sounding almost like a paraphrase of Cage's programmatic redefinition of radio reception as creative process.[29]

Max Neuhaus's series of broadcast works, starting in 1966, marks the beginning of the artistic re-invention of radio as a temporary appropriation and *mis*-use of the technical broadcasting system infrastructure. For *Public Supply* (1966) and *Radio Net* (1977), Neuhaus first found access to a regional broadcasting studio (WBAI New York), and later to the network of National Public Radio, for experimenting with a fundamental redefinition of their basic media-technological structures. By re-staging the «relatedness» between radio and telephone, lost in

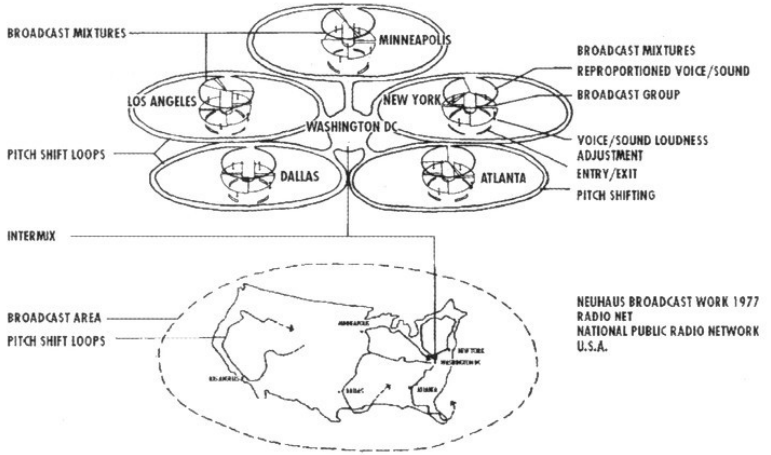
28 John Cage 1952, quoted in John Cage, *Silence* (Cambridge, MA, 1967), p. 59.

29 See on format radio Wolfgang Hagen, *Das Radio: Zu Geschichte und Theorie des Hörfunks – Deutschland / USA* (Munich, 2005), p. 326.

30 Max Neuhaus, «The Broadcast Works and Audium,» in *Zeitgleich* (Vienna, 1994).

31 The internationality and permanence which Neuhaus intended for *Audium* was an inspiration to internationally networked projects such as *Immersive Sound* (1998) and *Sound Drifting* (1999), both of which streamed nonstop from different locations over longer—potentially infinite—periods with a generative «soundpool»/«sound drifter» taking over in absence of people.

the mists of media history, Neuhaus opened up the broadcasting communications space to the audience. The dedicated lines over which stations exchange programming, generally not heard on-air, were turned into circulating, listener-based audio loops in *Radio Net*, creating a collective compositional instrument spanning a width of 2,400 km and a length of 4,800 km. Neuhaus additionally constructed new control devices and interfaces, enabling live mixing of the simultaneous audio sources. His goal, though, was not to achieve artistic control over these broadcasts as author/composer, but rather to install a self-executing system, unfolding—through the aesthetic participation/interaction of the user/listener—a social dimension. Radio no longer functions here as distribution medium, but instead as an autopoetic feedback system and as a «virtual place» for open communication «programmed by the people who use it,» as Neuhaus writes of his more recent autonomous telephone-radio installation, the yet unrealized *Audium*.[30] Here, Neuhaus explicitly refers to the anthropological component of his broadcast work by which he aims to emphasize the emotional and cross-cultural aspects of the human voice based on intonation and inflection.[31] This can be regarded as the practical counterpart to the earlier postulated necessity for a media-anthropological theory of radio.



Max Neuhaus, *Radio Net*, network diagram, 1977.

A further chapter in this synthesis of technical and conceptual re-invention of radio can be ascertained in the amalgamation of broadcast medium, Internet, data lines, and telephone for the projects initiated and organized by *Kunstradio* since the nineteen-nineties, especially in the *Horizontal Radio* project of 1995 as well as in others mentioned above.[32] This ongoing artistic and programmatic practice was labeled «Re-Inventing Radio» for a meeting of radio artists and radio activists at the Garage Festival in Stralsund (2004) as well as a subsequent conference and the *Long Night of Radio Art* at Ars Electronica the same year. Finally, the potentially ever-progressing *Re-Inventing Radio* project gave rise to the initiative for this book. The concept of re-invention is explored by several of the authors in this volume. «To rethink, reconceptualize, and revive the radio medium as an active, thinking, and engaged medium» is how Daniel Gilfillan sums up the objectives of these projects.[33] According to Anna Friz, this context also allows for «revisiting and reimagining trailing edge or ‹residual› technologies such as terrestrial radio.»[34] And Tetsuo Kogawa goes even further by deconstructing the «casting» in both broad- and narrowcasting by reminding us that radio is «not only a media form but also a phenomenon of radiation» and resonance.[35]

These experimental models of radio art in the nineteen-nineties are acting in a «time window,» where the liberating potential of the new technologies is emphasized, similar to the nineteen-sixties concepts of self-empowerment by media. Some artists see it as their task to keep this «time window» open as long as possible.[36] But is not the final affirmation for any avant-garde its going down in history while its models and proposals concurrently dissolve into the sphere of daily cultural practice? Today, the new paradigms of radio are comprised by the hybridization of the former mass medium with Internet and mobile phone technologies—as well as by the new role of the users and their active selection (exchanging, tagging), modification (remixing, sampling), and production (pod-

32 We will forgo a more detailed analysis here since several authors in this volume expound on *Horizontal Radio*. See, for example, Gilfillan, Dalò, and Arns in this volume.

33 Daniel Gilfillan, «Broadcast Space as Artistic Space,» in this volume.

34 Anna Friz, «Becoming Radio,» in this volume.

35 Tetsuo Kogawa, «Radio in the Chiasme,» in this volume.

36 See Robert Adrian, quoted in Kwastek 2004 (see note 19), p. 33.

37 The current interest shown by media artists in media archeology is therefore, as in Inke Arns's view, not nostalgic but rather a retrospection on the never-realized utopias of the media and, in this sense, a corrective for contemporary and future developments. See Inke Arns, «The Realization of Radio's Unrealized Potential,» in this volume.

casting, blogging) of content. The current hype of Web 2.0 is a testing ground for methods of commercial exploitation of this potential, where, if successful, the models developed by media amateurs and artists would ultimately be used to contravene their own goals, similar to the media transformation prompted by the radio boom of 1922. Are the radio and media artists hence the legitimate successors to the amateurs, who one hundred years ago reveled in the fascination of the ether, experimenting with a new application for radio, thereby unwittingly triggering the emergence of electronic mass media? Taking this perspective, some of the following contributions on the invention and re-invention of radio can be correspondingly read as part of a cyclical movement of twentieth-century media history, today echoing certain motifs from its early days.[37]